

CLAIMS:

The claimed inventions are:

1. A process for preparing roughened copper surfaces suitable for
5 subsequent multilayer lamination, said process comprising the
steps of: contacting with a clean copper surface an adhesion
promoting composition under conditions effective to provide a
roughened copper surface, said adhesion promoting composition
consisting essentially of hydrogen peroxide, a pH adjuster, a
10 topography modifier, and a uniformity enhancer, and at least
essentially free of halogen ions.
2. The process according to claim 1, wherein said process is
preceded with the optional step of providing a substantially clean
15 copper surface.
3. The process according to claim 1, wherein said process further
comprises the step of contacting the uniform roughened copper
surface with a post-dip.
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4. The process according to claim 3, wherein said post-dip
comprises an azole or silane compound or a combination of said
azole and said silane.

5. The process according to claim 4, wherein said post-dip further comprises a titanate, zirconate, aluminate or a combination of said titanate, zirconate and aluminate.
- 5 6. The process of claim 4, wherein said silane is selected from the group consisting essentially of
- 3-methylacryloyloxypropyltrimethoxysilane,
3-(N-styrylmethyl-2-aminoethylamino)
propyltrimethoxysilane hydrochloride,
10 3-(N-allyl-2-aminoethylamino)-propyltrimethoxysilane
hydrochloride,
N-(styrylmethyl)-3-aminopropyltrimethoxysilane
hydrochloride,
N-2-aminoethyl-3-aminopropyltrimethoxysilane,
15 3-(N-Benzyl-2-aminoethylamino)-propyltrimethoxy
silane hydrochloride,
beta-(3,4-epoxycyclohexyl) ethyltrimethoxysilane,
gamma-aminopropyl-triethoxy silane,
gamma-glycidoxypropyltrimethoxysilane, and
20 vinyltrimethoxysilane.
7. The process of claim 5, wherein said titanate is selected from the group comprising titanate amine, tetraacyl
di(ditridecyl)phosphito titanate, tetra(2,2-diallyloxymethyl)
25 butyl-di(ditridecyl)phosphito titanate, and neopentyl(diallyl)oxy-

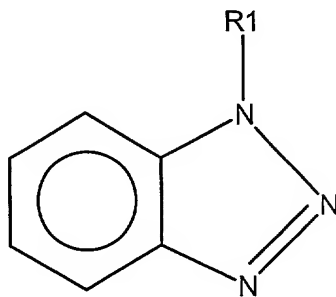
tri(dioctyl)pyrophosphatotitanate, and neopentyl(diallyl)oxytri-(m-amino)phenyl titanate.

8. The process of claim 5, wherein said zirconate is selected from
5 the group comprising tetra (2,2 diallyloxymethyl)butyl,
di(ditridecyl)phosphito zirconate, neopentyl(diallyl)oxy,
trineodecanoyl zirconate, neopentyl(diallyl)oxy,
tri(dodecyl)benzene-sulfonyl zirconate, tetra (2,2
diallyloxymethyl)butyl-di(ditridecyl)phosphito zirconate, and
10 zirconium IV 2,2-dimethyl 1,3-propanediolo.
9. The process of claim 5, wherein said aluminate is selected from
the group comprising diisobutyl(oleyl)acetoacetylaluminate, and
diisopropyl(oleyl)acetoacetyl aluminate.
- 15 10. The process according to claim 1, wherein said uniformity
enhancer is 5-aminotetrazole.
11. The process according to claim 1, wherein said adhesion
20 promoting composition further consists essentially of a copper
salt.
12. The process according to claim 1, wherein the process further
comprises the step of draining excess cleaning solution from the
25 copper surface.

13. A process for preparing roughened copper surfaces suitable for subsequent multilayer lamination, said process comprising the steps of: (a) applying a highly built alkaline cleaning solution to a copper surface to provide a substantially clean copper surface; and (b) dipping the clean copper surface into an adhesion promoting composition to provide a uniform roughened copper surface suitable for subsequent multilayer lamination, said adhesion promoting composition consisting essentially of an oxidizer, a pH adjuster, a topography modifier, and at least one of a uniformity enhancer and a coating promoter.
14. The process according to claim 13, said adhesion promoting composition including a coating promoter.
15. A process for increasing the adhesion of a dielectric material to a metal surface, wherein the metal surface comprises copper or copper alloys, said process comprising:
- (a) contacting the metal surface with an adhesion promoting composition comprising an adhesion-promoting effective amount of:
- (1) an oxidizer;
 - (2) an acid;
 - (3) a topography modifier; and

- (4) a coating promoter;
- (b) bonding the dielectric material to the metal surface.

16. A process according to claim 15 wherein the adhesion promoting
5 composition further comprises a uniformity enhancer.
17. A process according to claim 15 wherein the topography modifier is
a 5-membered aromatic fused N heterocyclic compound, wherein
the N heterocyclic ring has a nitrogen atom at position 1 bonded to a
10 hydrogen atom.
18. A process according to claim 15 wherein the coating promoter is a
5-membered aromatic fused N-heterocyclic compound with 1 to 3
nitrogen atoms in the fused ring, wherein none of said nitrogen
15 atoms are bonded to a hydrogen atom.
19. A process according to claim 15 wherein the coating promoter
has the following structure:



- 20 wherein **R1** is selected from the group consisting of hydroxyl
groups, amino groups, alkyl groups, hydroxyalkyl groups,

aminoalkyl groups, nitroalkyl groups, mercaptoalkyl groups, and alkoxy groups.

20. A process according to claim 15 wherein the coating promoter is
- 5 1-hydroxybezotriazole.